WHAT IS CLAIMED IS:

1. An optical semiconductor device comprising a semiconductor substrate having a surface with an etched and substantially V-shaped first groove portion, an optical element having an optical axis in a direction of the first groove portion and disposed on the surface, and a lens mounted in the first groove portion,

wherein the first groove portion comprises first and second opposing inclined surfaces and a third inclined surface perpendicular to the first and second inclined surfaces,

wherein a second groove portion is formed in the substrate that extends in a direction perpendicular to the direction of the first groove portion and the second groove portion includes the first, second, and third inclined surfaces, and

wherein the lens is mounted to the first and second inclined surfaces, a part of the lens protrudes in the second groove portion, and the optical element optically communicates through the lens.

2. An optical semiconductor device according to claim 1, wherein the second groove portion is a recess extending across the substrate.

3. An optical semiconductor device according to claim

1, wherein the lens has an edge portion, the second groove portion has a side wall, and the edge portion of the lens abuts the side wall of the second groove portion.

4. An optical semiconductor device according to claim 1, wherein the optical element is mounted on the surface of the substrate.

5. An optical semiconductor device according to claim 1, wherein the optical element is a light-emitting element.

6. An optical semiconductor device according to claim 4, wherein the light-emitting element is a semiconductor laser.

7. An optical semiconductor device according to claim 1, wherein the optical element is a light-receiving element.

8. An optical semiconductor device according to claim 6, wherein the light-emitting element is a photodetector.

9. An optical semiconductor device according to claim 7, wherein the photodetector is a photodiode.

10. An optical semiconductor device according to claim 1, wherein the second groove portion is a saw cut groove.

11. An optical semiconductor device according to claim 1, wherein the second groove portion is an etched groove.

12. An optical semiconductor device according to claim 1, wherein the second groove portion is a plasma-etched groove.

13. An optical semiconductor device according to claim 1, wherein the second groove portion is a wet chemical-etched groove.

14. An optical semiconductor device according to claim 1, wherein the second groove portion is substantially rectangular shaped.

15. An optical semiconductor device according to claim 1, wherein the second groove portion has a substantially circular shaped, machine cut sectional configuration with a radius set by a rotation shaft of a rotation member.

16. An optical semiconductor device according to claim 1, wherein the lens is an aspheric lens.

17. An optical semiconductor device according to claim 1, wherein the lens has a curved surface and the third inclined surface defines an enclosure that accepts the curved surface of the lens.

18. An optical semiconductor device according to claim 1, wherein the third inclined surface has an upper edge and the optical element is disposed adjacent to the upper edge.

19. An optical semiconductor device according to claim 1, wherein the first groove portion has a first depth, the second groove portion has a second depth, and the first depth is larger than the second depth.

20. An optical semiconductor device according to claim 2, wherein the recess extends across an entire region of the substrate that encompasses the optical semiconductor device.

21. An optical semiconductor device according to claim 3, wherein the edge portion of the lens has opposing ends and the second groove portion does not extend significantly further than the opposing ends of the edge portion.

22. An optical semiconductor device according to claim 1, wherein the semiconductor substrate is a silicon substrate.

23. An optical semiconductor device according to claim 1, wherein the semiconductor substrate is a III-V substrate.

24. A method of increasing coupling efficiency between

an optical element disposed on a surface of a silicon substrate and an optical fiber, the method comprising positioning a lens disposed in an etched and substantially V-shaped first groove portion of the substrate having a first groove direction and having first and second opposing inclined surfaces and a third inclined surface perpendicular to the first and second inclined surfaces such that a part of the lens protrudes in a second groove portion extending in a direction perpendicular to the first groove direction and including the first, second, and third inclined surfaces.

25. The method according to claim 24, further comprising positioning an edge portion of the lens to abut a side wall of the second groove portion.

26. The method according to claim 24, further comprising transmitting optical signals between the optical element and the optical fiber.

27. The method according to claim 24, further comprising determining an optimum position of the lens for optical communication between the optical element and the optical fiber.

28. The method according to claim 27, further comprising fixing the optimum position of the lens subsequent to positioning the lens.

29. The method according to claim 28, further comprising transmitting optical signals between the optical element and the optical fiber subsequent to fixing the optimum position of the lens.

30. The method according to claim 24, further comprising fixing a position of the lens subsequent to positioning the lens.

31. The method according to claim 30, further comprising transmitting optical signals between the optical element and the optical fiber subsequent to fixing the position of the lens.

32. A method of producing an optical semiconductor device that increases the coupling efficiency between an optical element disposed on a surface of a silicon substrate and an optical fiber, the method comprising:

etching first and second opposing inclined surfaces and a third inclined surface perpendicular to the first and second inclined surfaces to form a substantially V-shaped first groove portion in the substrate; and

forming a second groove portion in the substrate such that the second groove portion extends in a direction perpendicular to a direction of the first groove portion and includes the first, second, and third inclined surfaces.

33. The method according to claim 32, further comprising positioning a lens in the first and second inclined surfaces such that a part of the lens protrudes in the second groove portion.

34. The method according to claim 32, further comprising mounting the optical element to the surface of the substrate.

35. The method according to claim 32, further comprising extending a recess that forms the second groove portion across the substrate.

36. The method according to claim 32, the forming of the second groove portion further comprising machining the substrate such that the second groove portion is sawed in a single direction.

37. The method according to claim 32, further comprising etching the substrate to form the second groove portion.

38. The method according to claim 32, further comprising plasma-etching the substrate to form the second groove portion.

39. The method according to claim 32, further comprising wet-chemical etching the substrate to form the second groove portion.

40. The method according to claim 32, further comprising forming a substantially rectangular shaped second groove portion.

41. The method according to claim 32, further comprising machining the second groove portion to have a substantially circular shaped sectional configuration and setting a radius of the second groove portion by a rotation shaft of a rotation member.

42. The method according to claim 33, further comprising forming the third inclined surface to define an enclosure that accepts a curved surface of the lens.

43. The method according to claim 34, further comprising mounting the optical element adjacent to an upper edge of the third inclined surface.

44. The method according to claim 32, further comprising forming the second groove portion such that a depth of the second groove portion is smaller than a depth of the first groove portion.

45. The method according to claim 35, further comprising extending the recess across an entire region of the substrate that encompasses the optical semiconductor device.

45. The method according to claim 33, further comprising forming the second groove portion such that the second groove portion does not extend significantly further than opposing ends of an edge portion of the lens.

46. The method according to claim 45, further comprising forming a side wall of the second groove portion and abutting the edge portion of the lens against the side wall of the second groove portion.

47. The method according to claim 32, further comprising transmitting optical signals between the optical element and the optical fiber.

48. The method according to claim 33, further comprising determining an optimum position of the lens for optical communication between the optical element and the optical fiber.

49. The method according to claim 48, further comprising fixing the optimum position of the lens subsequent to positioning the lens.

50. The method according to claim 49, further comprising transmitting optical signals between the optical element and the optical fiber subsequent to fixing the optimum position of the lens.

51. The method according to claim 33, further comprising fixing a position of the lens subsequent to positioning the lens.

52. The method according to claim 51, further comprising transmitting optical signals between the optical element and the optical fiber subsequent to fixing the position of the lens.